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NPTEL ONLINE
CERTIFICATION COURSE

QUANTITATIVE INVESTMENT MANAGEMENT

LECTURE 54 Futures Hedging

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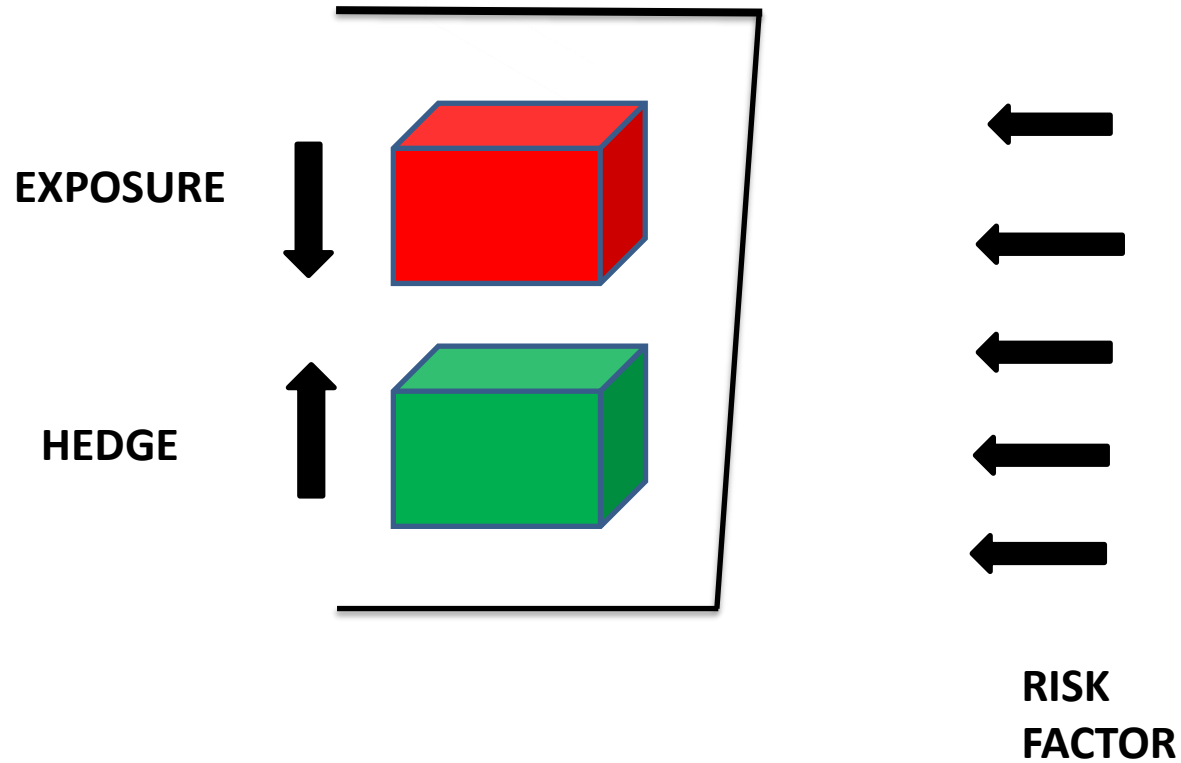
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FUTURES HEDGING



HEDGING DEPICTED



HEDGING

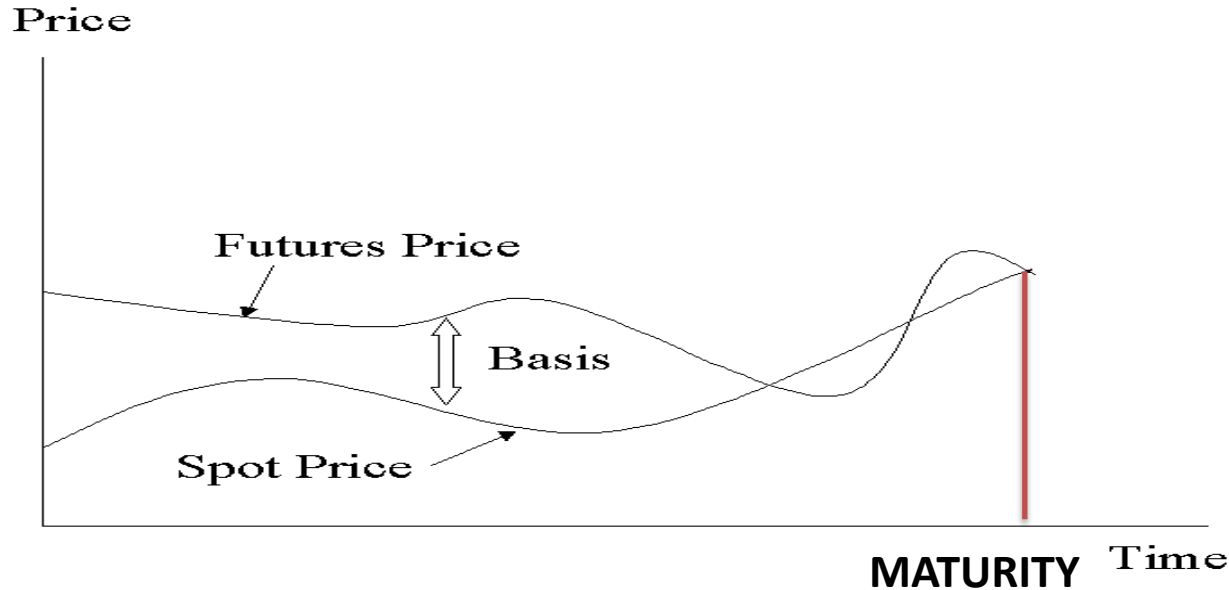
- A hedge is an investment position intended to offset potential losses **or gains** (that is changes in value whether negative or positive) that may be incurred by a companion investment.
- Hedging is the practice of taking a position in one market to offset and balance against the risk adopted by assuming a position in a contrary or opposing market or investment.



BASIS & BASIS RISK

- Basis at any instant of time t is given by $b_t = S_t - F_t$.
- Since both S_t and F_t are stochastic processes and evolve in time with a random element, the basis is also a stochastic process.
- The basis is, therefore not precisely predictable at a future instant of time or that it will remain constant.
- This unpredictability of the basis causes imperfection in futures hedging termed as basis risk.
- **Nevertheless, no arbitrage dictates that basis $b_T \rightarrow 0$ at maturity of the futures contract.**

CONVERGENCE OF SPOT & FUTURES ON MATURITY: ARBITRAGE AGAIN!!!!



HOW DOES A FUTURES HEDGE OPERATE?

- **There, usually, exists a positive correlation between spot and futures prices.**
- **Hence, if one has a portfolio consisting of opposite positions in the spot and futures markets, the price changes in one market will substantially offset the price changes in the other market.**
- **The degree of offsetting will depend on the level of correlation between the two markets.**



HEDGING: BETTER VS CERTAIN OUTCOME

Hedging of a position leads to a more certain outcome.

It may or may not ultimately result to a better outcome.



HEDGING: BETTER VS CERTAIN OUTCOME

SPOT PRICE $t=0$	60	60	60
QUANTITY	100	100	100
SPOT PRICE $t=T$	50	60	70
FUTURES PRICE $t=0$	62	62	62
FUTURES PRICE $t=T$	50	60	70
FUTURES QUANTITY	100	100	100
CHANGE IN SPOT VALUE	-1000	0	1000
CHANGE IN FUTURES VALUE	-1200	-200	800
NET CHANGE	200	200	200

PERFECT VS IMPERFECT HEDGE

- A hedge is deemed perfect when the cash flows at maturity are known with certainty.
- Forward is a perfect hedge.
- Futures is imperfect hedge.



LONG HEDGE

- Hedges that involve taking a long position in a futures contract are known as long hedges.
- A long hedge is appropriate when a company knows it will have to **purchase a certain asset** in the future and wants to lock in a price now.



SHORT HEDGE

- A short hedge is a hedge that involves a short position in futures contracts.
- A short hedge is appropriate when the hedger already owns an asset and expects to sell it at some time in the future.
- A short hedge can also be used when an asset is not owned right now but will be owned at some time in the future.



SHORT HEDGING & BASIS

- Price at which underlying is sold in the spot market at maturity of hedge period = S_T
- Profit from the short futures position, that was created at F_0 at $t=0$ and closed out at F_T at $t=T$ is $F_0 - F_T$
- Net proceeds from the hedged transaction = $S_T + F_0 - F_T = F_0 + (S_T - F_T) = F_0 + b_T$

- While F_0 is known upfront, b_T being the basis at $t=T$, is not.
- It is b_T that captures the randomness element.
- If hedge maturity coincides with futures maturity, $b_T \rightarrow 0$ and the net price received is F_0 which is known upfront and thus there is no randomness due to maturity mismatch

LONG HEDGE & BASIS

- Similarly, the net price paid by a long hedger= -
 $S_T + F_T - F_0 = -F_0 - (S_T - F_T) = -(F_0 + b_T)$
- Thus, if the basis weakens unexpectedly,
- Long hedger gains & short hedger loses & vice versa.

WHY FUTURES HEDGE IS NOT A PERFECT HEDGE?

- Marking to market.
- **Basis risk due to:**
- Different underlying asset.
- Non-identical maturity.
- Lot size issue.

